Exam.Code:0928
Sub. Code: 6586

2023

B.E. (Electronics and Communication Engineering)

Fourth Semester

EC-407: Probability and Random Processes

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section. Use of scientific calculator is allowed.

x-x-x

I. (a) What is channel coding? (1)

(b) Differentiate between random variable and random process. (2)

(c) What is Hilbert transform? (2)

(d) What is baseband and passband communication? (2)

(e) Explain significance of noise temperature of a network. (1)

(f) Define ergodicity. (1)

(g) Define noise figure. (1)

Section-A

II. (a) The probability density function of random variables X is given below:

$$f_X(x) = \begin{cases} 3(1-x)^2 & 0 \le x \le 1 \\ 0 & x < 0, \ x > 1 \end{cases}$$

(i) Find the mean of random variable X.

(ii) Determine variance of random variables X. (3)

(b) Represent a band-pass signal in terms of its in-phase and quadrature components. (4)

(c) Define phase delay and group delay. (3)

III. (a) What is a filter? Explain its types. (3)

(b) Define random process. Explain correlation and covariance functions of a random process. (3)

(c) State and explain central limit theorem. (4)

IV. (a) Define an LTI system. (2)

(b) Explain Poisson distribution alogwith its derivation. (5)

(c) Explain various sources of information. (3)

Section-B

V. (a) State and explain Shannon's channel coding theorem. (3)

(b) Describe FRIIS equation. (3)

(c) Determine the Huffman code for the following messages with their probabilities given as:

Message	m_1	m_2	m_3	m_4	m_5
Probability	0.4	0.2	0.2	0.1	0.1

Also determine code efficiency. (4)

VI. (a) An analog signal band-limited to 10 kHz is quantized in 8 levels of a PCM system with probabilities of 1/4, 1/5, 1/5, 1/10, 1/10, 1/20, 1/20 and 1/20 respectively. Find the entropy of the source and the rate at which information is being transmitted. (3)

(b) Define noise. Explain its types and their characterization in detail. (5)

(c) State and explain Shannon's channel capacity theorem. (2)

VII. (a) Define narrowband noise. Express this noise in terms of in-phase and quadrature components.

(b) The bandwidth of a channel is 3.4 kHz. (5)

(i) Calculate the information capacity of the channel for a signal-to-noise ratio of 30 dB.

(ii) Calculate the minimum signal-to-noise ratio required to support information transmission through the channel at the rate of 9.6 kbps.

(c) Define the information and entropy. Explain their properties. (2) (3)

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